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CDOT I-25 Cimarron Street (US 24) Design Build
Water Quality Approach

Parsons Brinckerhoff has reviewed the Preliminary Hydrology and Hydraulics Report for Interstate Highway 25 Improvements Cimarron / Bijou Interchange, Colorado Springs, Colorado, CDOT Project IM 02520334 (the "Report") as prepared by Wilson & Company in 2003 for comparison with the CDOT I-25 Cimarron Street (US 24) project as proposed today for major differences affecting the stormwater runoff and hydrology between the then and current conditions.

The overall scope of the project is lesser today. At the time of the Report, the project covered a larger area with limits on the south starting roughly 4000 feet south of Cimarron Street and extending north of Bijou Street, by 2600 feet. As a result, the report analyzed a 1.9 mile stretch of Interstate 25 including 4 through lanes and an auxiliary lane in each direction. The Report focused primarily on upstream flows tributary to the 1.9 mile section of highway and conveyance of those flows across the highway corridor, but it did not focus on project specific basins associated with the proposed interstate and ramp improvements.

A conceptual drainage basin map has been prepared for the current project and is provided as Attachment 1 hereto. The project has been divided into 9 conceptual sub-basins with a total area of approximately 32 acres. The imperviousness of each basin has been calculated for the existing and proposed condition. Attachment 2 provides a table which identifies the differences in impervious area for each sub-basin in the pre- and post-construction condition. In the existing condition, prior to the project improvements, approximately 17 acres of the 32 acre basin are impervious. The project proposes an additional 9.3 acres of impervious area for a total, post construction impervious area of approximately 26.3 acres, an approximate increase of 35.5%. The project shall provide for the necessary detention to mitigate any increased flows as a result of the increased impervious area and shall also provide water quality for the 32 acre basin.

The most significant difference between the 2003 Report assumptions and now are the requirements for capture and treatment of the project runoff for water quality. Water quality was mentioned in the Report, but never accounted for in the layout of the conceptual drainage system included in the Report. Due to the project being located immediately adjacent to the confluence of Fountain Creek and Monument Creek, flows from the project must be captured immediately to prevent direct runoff into the creeks as several of the proposed embankments discharge immediately into the creek system. This will likely require a more substantial and complex storm sewer collection system than was detailed in the Report. In order to capture the runoff a storm sewer collection system

including concrete barriers and curbs and gutters will be required to route the runoff into a series of proposed inlets. Storm sewer pipes and culverts will be required to route the captured water to proposed extended detention basins, grass swales and water quality vaults for treatment of the runoff before release downstream.

WATER QUALITY APPROACH

Runoff from the project area must be treated to meet minimum water quality requirements as set forth in CDOT's MS4 permit. To comply with the MS4 permit, 100% of the project pavement area must either be captured and treated for 100% of the water quality capture volume (WQCV) or an alternative means of removing 80% of the Total Suspended Solids (TSS) shall be provided before discharge downstream. In order to capture and treat the runoff, a system including several conveyance and treatment methods including extended detention basins (EDBs), grass swales with rock checks, and water quality vaults / manholes are proposed. A conceptual collection and treatment system has been prepared and is detailed in Attachment 3.

The general flow pattern along Interstate 25 is from north to south as the highway gains elevation as it travels northerly. This allows the runoff from Basins A and B in the northern segments of the project to be captured with concrete barrier, curb, gutter and inlets and routed southerly to the infield areas of the proposed ramps along Cimarron Street. The ramp infield areas are the only areas of the project where the topography and available right-of-way allow for the construction of extended detention basins. The conceptual plan proposes four (4) new EDBs located at each of the ramps as shown in Attachment 3. The complexity of the collection system throughout the project is that a large portion of the proposed roadway cross section is superelevated and causes the runoff to travel easterly toward the center median and to the eastern edge of the northbound shoulder which falls directly into Monument Creek. As a result, a collection system must be designed with the project that can not only capture this flow in the proposed condition but that can also be readily converted with the future phase to accommodate and capture the center auxiliary lanes. The storm sewer pipes should be sized and located with this project to account for the future developed flows associated with the center auxiliary lanes and associated center barriers.

South of the Cimarron mainline bridge, the Interstate 25 cross section is in normal crown but quickly transitions again into superelevation causing the runoff to again flow easterly toward the center median and to the eastern edge of the northbound shoulder. In order to prevent the runoff from entering Monument Creek to the east, a combination of concrete barrier and curb and gutter is required to collect the water so that it can be detained and treated for water quality. As a result, the conceptual plan proposes to collect Basins C and D which is that area from the Cimarron bridge approximately 750 feet south, with concrete barrier, curb and gutter and inlets and then pipe the stormwater into the proposed EDBs on the south side of Cimarron Street for treatment as shown on Attachment 3.

There is not enough available space to construct either EDBs or grass swales with rock checks. In the area of Basins E and F, which is that area from the Bear Creek crossing traveling north to

approximately 750 feet south of the Cimarron bridge. Due to limitations caused by the proposed embankment slopes and relative closeness to Monument Creek on the east, the storm water must be routed to two (2) water quality vaults / manholes located on the east side of the interstate to treat that section of highway before release into Monument Creek.

Immediately south of the Bear Creek crossing there again is not adequate space to construct EDBs, but there is room to construct a single grass swale with rock checks on the west side of the southbound shoulder. Although this section is also in superelevation with flow traveling toward the center median island and the northbound shoulder, away from the west side ditch, the use of concrete barrier or curb and gutter on the east side of the northbound shoulder will allow the runoff from Basin G to be captured and piped via cross culvert back to the west side where the grass swale with rock checks can provide water quality treatment for this section of highway.

In the area of Basin H, which is located approximately 400 feet south of the Bear creek crossing to the southern limits of the project, the requirement for curb and gutter is no longer needed for collection as adequate space is provided for construction of roadside ditches on both sides of Interstate 25. This section is the only section of the project in which traditional roadside ditches can be utilized to convey the runoff. However, due to the water quality requirements, the roadside ditches in this section of the project should be constructed as grass swales with rock checks to provide the required removal of total suspended solids.

Extended Detention Basins

Extended Detention Basins (EDB)s shall be designed in accordance with the UDFCD Volume 3, to capture 100% of Water Quality Capture Volume (WQCV) with a 40-hr drain time for the outlet design. The WQCV is equivalent to 0.5-inch of rainfall from the impervious contributing area and will be stored within the EDB and designed to be released over a 40 hour drain time.

Grass Swales with Rock Check Dams

Grass swales with rock check dams shall be used along the project in locations where the runoff cannot be conveyed to a downstream extended detention basin due to either topographic or right-of-way constraints. Grass swales are vegetated channels with maximum side slopes of 3:1 and are designed to convey flow in a slow and shallow manner to facilitate sedimentation and filtering. Grass swales with rock check dams will function efficiently to remove sediments, solids, metals and nutrients. The grass swales together with the effect of the rock check dams shall be designed to achieve an 80% removal of Total Suspended Solids (TSS). Water quality treatment will be provided by providing smaller Water Quality Capture Volumes behind each individual rock check dam. The runoff will be held behind each rock check dam and infiltrated into the soil.

Water Quality Vaults / Manholes

In limited locations where EDBs and Grass Swales with Rock Checks are not feasible and where the tributary area is less than 2 acres, proprietary water quality vaults or manholes are recommended for use only on a limited basis. Proprietary water quality vaults/manholes must achieve an 80% Total Suspended Solids (TSS) removal and shall be designed to treat the runoff from the minor storm event by means of hydrodynamic separators. Water quality vaults/manholes shall be sized in accordance with several constructability requirements based on the input data provided by the Engineer. Maintenance of all water quality vaults / manholes shall be performed in accordance with manufacturer's requirements.

Temporary Erosion Control & Construction BMPs

The construction stormwater management plans for this project shall be completed by the Contractor and shall be certified by a Colorado licensed Professional Engineer in accordance with the CDOT M & S Standards and Erosion Control and Stormwater Quality Guide. The Contractor shall be responsible for maintaining erosion control documentation, identifying erosion control for temporary construction needs and for permanent stormwater management needs, installation of best management practices (BMPs), inspection and maintenance of all BMPs, and maintenance of all BMPs throughout the life of the project.

At the conceptual level it is assumed that the construction BMPs will include at a minimum; storm drain inlet protection, outlet protection, vehicle tracking pads, sediment control logs, temporary stabilization, silt fence, check dams, hazardous waste and spill containment, concrete washout and saw water disposal, timely reseeding and mulching and other final stabilization measures including soil retention blankets and frequent pavement sweeping. The BMPs will be situated to reduce the impact of the associated sediment loading on the receiving waters. Construction BMPs shall be maintained and repaired continuously by the Contractor throughout the duration of the project.

Erosion Control Mats, Turf Reinforcement, and Armor Protection

Erosion control mats shall be provided for all proposed grass swales with rock checks and along all disturbed areas with slopes greater than or equal to 4:1. Shear stress calculations shall be prepared to determine the flow velocities and erosion control mats shall be specified to meet the calculated shear stresses. Alternative means such as turf reinforcing mats and/or riprap armoring shall be specified where shear stress exceeds the maximum allowed by the erosion control mat manufacturer's specifications. Any ditches with a flow velocity of more than 5 ft/sec that do not have rock check dams shall be protected with riprap armoring. Riprap sizing calculations shall be performed in accordance with CDOT's criteria manual.

ATTACHMENTS

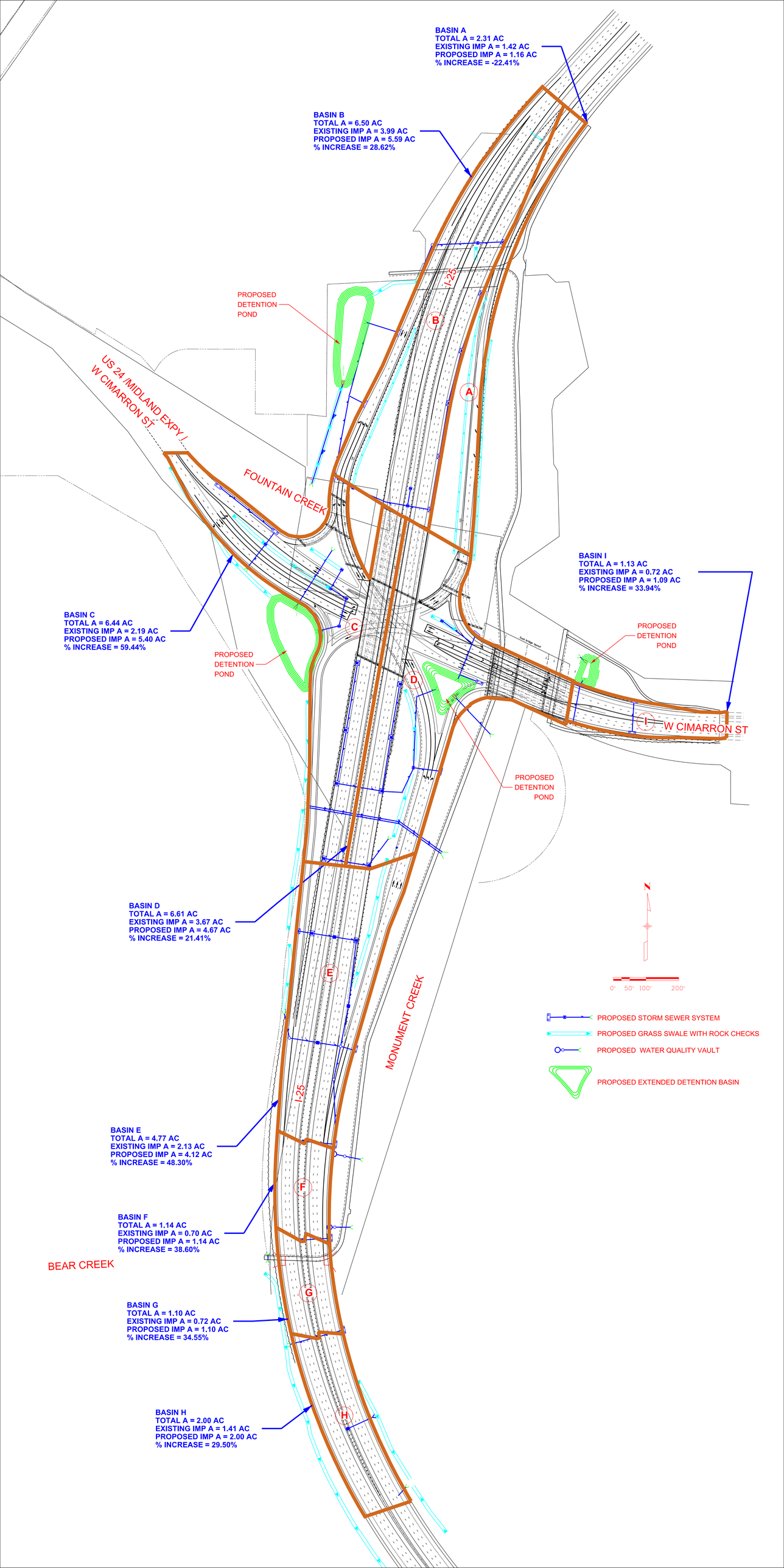
ATTACHMENT 1
Proposed Conceptual Drainage Basin Map

ATTACHMENT 2
Existing and Proposed Impervious Values

ATTACHMENT 3
Conceptual Stormwater Collection System and Permanent Water Quality BMPs

ATTACHMENT 1

Proposed Conceptual Drainage Basin Map


BASIN A
TOTAL A = 2.31 AC
EXISTING IMP A = 1.42 AC
PROPOSED IMP A = 1.16 AC
% INCREASE = -22.41%
BASIN B
TOTAL A = 6.50 AC
EXISTING IMP A = 3.99 AC
PROPOSED IMP A = 5.59 AC
% INCREASE = 28.62%
PROPOSED DETENTION POND
I-25
B
A
US 24 /MIDLAND EXPY /
W CIMARRON ST
FOUNTAIN CREEK
BASIN I
TOTAL A = 1.13 AC
EXISTING IMP A = 0.72 AC
PROPOSED IMP A = 1.09 AC
% INCREASE = 33.94%
BASIN C
TOTAL A = 6.44 AC
EXISTING IMP A = 2.19 AC
PROPOSED IMP A = 5.40 AC
% INCREASE = 59.44%
PROPOSED DETENTION POND
C
D
PROPOSED DETENTION POND
I
W CIMARRON ST
PROPOSED DETENTION POND
BASIN D
TOTAL A = 6.61 AC
EXISTING IMP A = 3.67 AC
PROPOSED IMP A = 4.67 AC
% INCREASE = 21.41%
E
MONUMENT CREEK
I-25
BASIN E
TOTAL A = 4.77 AC
EXISTING IMP A = 2.13 AC
PROPOSED IMP A = 4.12 AC
% INCREASE = 48.30%
F
BASIN F
TOTAL A = 1.14 AC
EXISTING IMP A = 0.70 AC
PROPOSED IMP A = 1.14 AC
% INCREASE = 38.60%
BEAR CREEK
G
BASIN G
TOTAL A = 1.10 AC
EXISTING IMP A = 0.72 AC
PROPOSED IMP A = 1.10 AC
% INCREASE = 34.55%
BASIN H
TOTAL A = 2.00 AC
EXISTING IMP A = 1.41 AC
PROPOSED IMP A = 2.00 AC
% INCREASE = 29.50%
H
N
0' 50' 100' 200'
PROPOSED STORM SEWER SYSTEM
PROPOSED GRASS SWALE WITH ROCK CHECKS
PROPOSED WATER QUALITY VAULT
PROPOSED EXTENDED DETENTION BASIN

ATTACHMENT 2

Existing and Proposed Impervious Values

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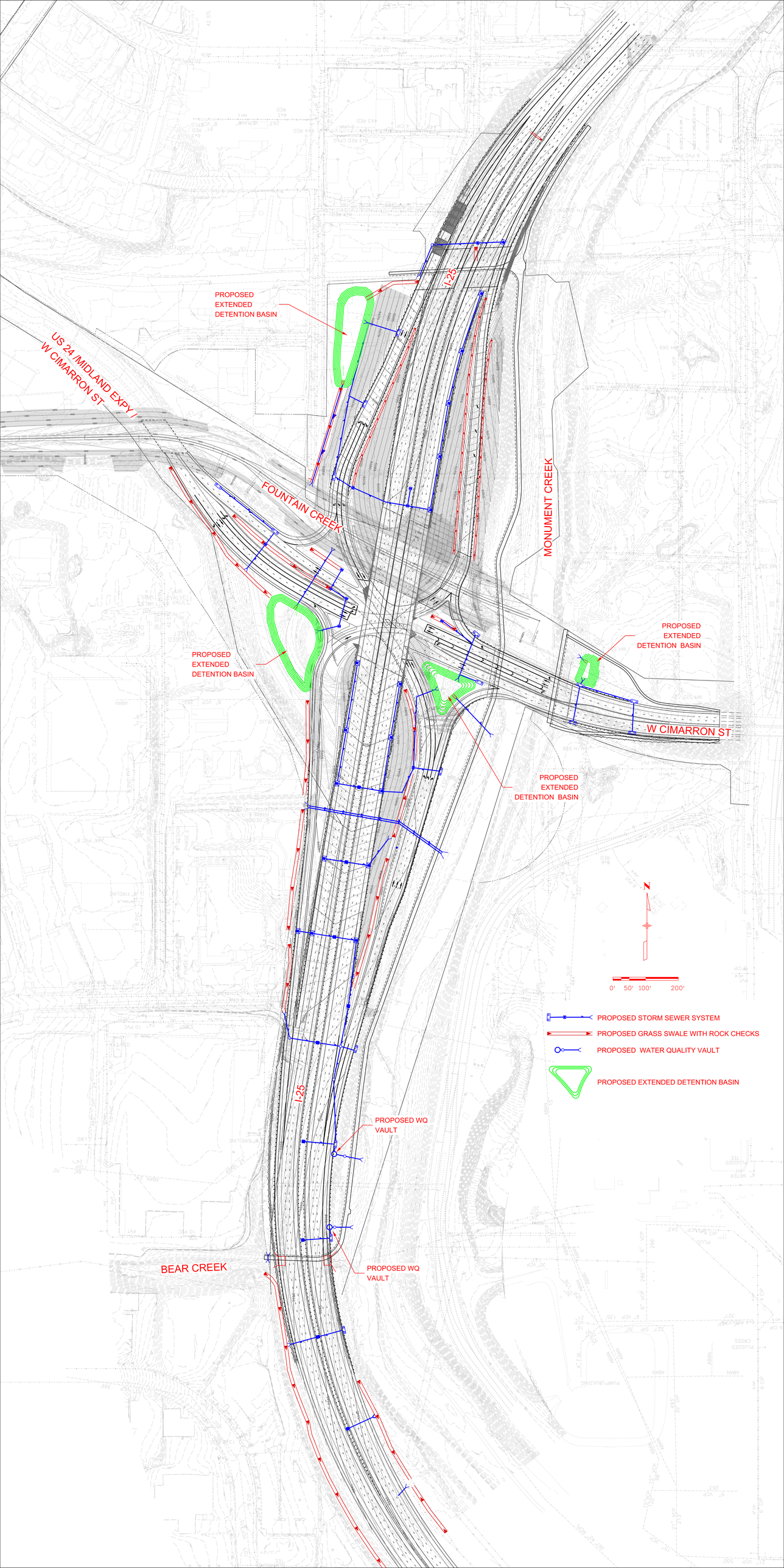
BASIN	TOTAL AREA	EXISTING IMPERVIOUS	PROPOSED IMPERVIOUS	% INCREASE
	AC	AC	AC	
A	2.31	1.42	1.16	-22.41%
B	6.50	3.99	5.59	28.62%
C	6.44	2.19	5.40	59.44%
D	6.61	3.67	4.67	21.41%
E	4.77	2.13	4.12	48.30%
F	1.14	0.70	1.14	38.60%
G	1.10	0.72	1.10	34.55%
H	2.00	1.41	2.00	29.50%
I	1.13	0.72	1.09	33.94%
Total	32.00	16.95	26.27	**35.48%**

ATTACHMENT 3

Conceptual Stormwater Collection System and Permanent Water Quality BMPs


PROPOSED
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PROPOSED
EXTENDED
DETENTION BASIN
PROPOSED
EXTENDED
DETENTION BASIN
W CIMARRON ST
PROPOSED
EXTENDED
DETENTION BASIN
N
0'
50'
100'
200'
PROPOSED STORM SEWER SYSTEM
PROPOSED GRASS SWALE WITH ROCK CHECKS
PROPOSED WATER QUALITY VAULT
PROPOSED EXTENDED DETENTION BASIN
I-25
PROPOSED WQ
VAULT
BEAR CREEK
PROPOSED WQ
VAULT